Good outcomes from cardiac surgery in the over 70s

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Abstract

***Objective*—To determine the early mortality and major morbidity associated with cardiac surgery in the elderly.**

***Design*—Retrospective case record review study of 575 patients ⩾ 70 years old who underwent cardiac surgery at the Manchester Heart Centre between January 1990 and December 1996.**

***Setting*—Regional cardiothoracic centre.**

***Subjects*—Patients ⩾ 70 years old who underwent cardiac surgery.**

***Main outcome measures*—Comparison of 30 day mortality and incidence of major morbidity between patients ⩾ 70 years old and patients < 70 years old.**

***Results*—Of 4395 cardiac surgical operations, 575 operations (13.1%) were in patients aged ⩾ 70 years (mean (SD) 73.1 (3.2) years). The proportion of elderly patients rose progressively from 7.9% in 1990 to 16.5% in 1996. 334 patients (58.1%) had coronary artery bypass grafting alone, 91 patients (15.8%) had valve surgery alone, and 129 patients (22.4%) had combined valve surgery and bypass grafting. For isolated coronary artery bypass grafting, 30 day mortality in patients ⩾ 70 years was 3.9% compared with 1.3% in patients < 70 years (p < 0.001). 30 day mortality for isolated valve surgery in patients ⩾ 70 years was 7.7%. Isolated aortic valve replacement was the most common valvar procedure in patients ⩾ 70 years and carried the lowest mortality (4.3%). Additional coronary artery bypass grafting increased the mortality rate in patients ⩾ 70 years to 9.3% for all valve surgery and to 8.0% for aortic valve replacement. Major morbidity in patients ⩾ 70 years was low for all procedure types (stroke 1.9%, acute renal failure requiring dialysis 1.6%, perioperative myocardial infarction 0.5%).**

***Conclusions*—Early mortality and major morbidity is low for cardiac surgery in elderly patients. Concerns over the risk of cardiac surgery in the elderly should not prevent referral, and elderly patients usually do well. However, unconscious rationing of health care may affect referral patterns, and studies that assess the cost effectiveness of cardiac surgery versus conservative management in such patients are lacking.**

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Keywords: cardiac surgery; elderly; mortality; coronary artery bypass grafting; valve replacement

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As the population steadily ages, more elderly patients are considered for cardiac surgery. Older subjects have the highest prevalence of cardiac disease and are more likely than younger patients to have medically refractory symptoms, but they are less likely to be suitable for less invasive procedures such as coronary angioplasty.[1 2] Surgical intervention may often appear imperative. Despite a large increase in the number of cardiac surgical procedures in elderly patients in the past decade, particularly in coronary artery bypass grafting,[3 4] there are few published data on the safety and efficacy of such surgery. Available data come predominantly from the US, but differences in patient selection, surgical and bypass technique, and data collection make it difficult to draw firm conclusions for the UK. These studies suggest that morbidity and mortality is significantly increased in older patients, but the operative risk is acceptable and the long term outlook in survivors is good.[3–11] There is a perception that cardiac surgery in the over 70s carries a prohibitively high risk and there may be a reluctance to refer elderly patients with severe cardiac symptoms for this reason. This study reviews the experience and outcome of cardiac surgery in 575 patients ⩾70 years old at the Manchester Heart Centre between 1990 and 1996.

Patients and methods

Since 1990 the policy of the Manchester Heart Centre is to accept all patients referred for surgery, irrespective of age, unless they have irreversible severe left ventricular dysfunction, unacceptably high risk of perioperative stroke (because of severe bilateral carotid atheroma, for example) or severe intercurrent illness—for example, carcinomatosis. Of 4395 cardiac surgical operations at the Manchester Heart Centre between January 1990 and December 1996, 575 operations (13.1%) were in patients ⩾ 70 years old. The number and proportion of elderly patients rose progressively over the seven year study period from 38 (7.9%) in 1990 to 129 (16.5%) in 1996 (table 1). Data for this report were obtained by retrospective review of medical

Table 1 Incidence of cardiac surgery in patients ⩾ 70 years old

Year	*Total number of cardiac operations*	*Patients ⩾ 70 years (n (%))*
1990	452	38 (7.9)
1991	444	41 (9.2)
1992	525	61 (11.6)
1993	652	70 (10.7)
1994	744	102 (13.7)
1995	773	117 (15.1)
1996	785	129 (16.5)

Table 2 Patterns of cardiac surgery at Manchester Heart Centre 1990–96

	< 70 years of age		≥ 70 years of age		
	Number	%	Number	%	p value
Sex					
Male	2856	74.8	368	64	< 0.0001
Female	964	25.2	207	36	
Priority					
Elective	2600	68.1	318	55.3	< 0.0001
Urgent	1106	28.9	232	40.3	
Emergency	114	3	25	4.4	
Type of surgery					
CABG only	3058	80.1	334	58.1	< 0.0001
Valve only	371	9.7	91	15.8	
CABG + valve	219	5.7	129	22.4	
Re-do surgery	316	8.3	42	7.3	NS

CABG, coronary artery bypass surgery.

case notes, and perfusion and operation records. Demographic data, preoperative risk factors, preoperative cardiac status, surgical status, type of surgical procedure, postoperative course, and postdischarge follow up records were noted. The terms used in this study were based on the definitions of the Society of Thoracic Surgeons (appendix).[12]

Statistical comparisons between the elderly population and the under 70s or between the different operation types in the elderly population were made using the χ^2 test for discrete variables or by Student's *t* test for continuous variables. Significance was defined as $p < 0.05$.

Results

Five hundred and seventy five operations were undertaken in patients ≥ 70 years old. The median age at surgery was 72 years (range 70–89). Thirty patients (5.2%) were ≥ 80 years old. The proportion of female patients in the elderly group was significantly higher than in patients < 70 years. The elderly group also contained a higher proportion of non-elective surgery and valve surgery (table 2). There were similar numbers of repeat operations in the two groups.

Of the 334 patients ≥ 70 years who underwent coronary artery bypass grafting alone, 96 (28.7%) had unstable angina preoperatively, 40 had left main stem stenoses > 50%, 27 had poor left ventricular function (8.1%), 21 were diabetic (3.7%), and 25 had a past history of cerebrovascular disease (4.4%). Almost 50% of patients had suffered a previous Q wave myocardial infarction but only 13 (3.9%) within 28 days of surgery. The mean (SD) age at surgery was 72.6 (2.7) years. One hundred and seventy six cases were elective procedures, 143 were urgent, and 15 were emergencies. Elderly patients had fewer grafts than younger patients. Mean number of grafts for patients ≥ 70 years was 4.9 (1.2) (range 2–11, mode 5). For the under 70 population over the same period the mean number of grafts was 5.1 (1.5) ($p < 0.05$). Arterial conduits were used in 73.4% of patients ≥ 70 years overall (compared with 88.2% of under 70s, $p < 0.0001$) but in 80.7% of elective cases. Left internal mammary artery (LIMA) grafting alone was performed in 227 patients ≥ 70 years, and bilateral internal mammary artery (BIMA) grafting was performed in 27 patients.

Table 3 Valve procedures in patients ≥ 70 years old

Procedure	Number of operations
AVR + CABG	96
AVR only	64
MVR + CABG	16
MVR only	12
DVR	11
DVR + CABG	8
MV repair + CABG	6
MV repair	3

AVR, aortic valve replacement; CABG, coronary artery bypass grafting; DVR, double valve replacement; MV, mitral valve; MVR, mitral valve replacement.

Elderly patients undergoing valve surgery alone or valve surgery with coronary artery bypass grafting were significantly older than patients undergoing coronary artery bypass grafting alone (mean age 74 (3.7), $p < 0.001$). Valve surgery consisted of aortic valve replacement in the majority of cases, with a much smaller number of procedures involving the mitral valve (table 3). Calcific aortic valvar stenosis was by far the most common indication for valve surgery, and accounted for 135 cases (61.4%).

Mechanical prosthetic valves were used in 64% of cases. All 49 mitral valve replacements were mechanical. Of 175 aortic valve replacements, 94 (53.7%) were mechanical although a higher proportion of biological valves was used where the aortic valve was replaced, without coronary artery bypass grafting, for aortic stenosis (29 of 47 cases). This represented the oldest group of patients in the study (mean age 75.1 (4.1) years); the development of restenosis or valvar incompetence was thought less likely to become a clinical problem and avoidance of long term anticoagulation was considered desirable.

The 30 day mortality in patients ≥ 70 years was 6.8%, compared with 2.5% for younger patients ($p < 0.0001$) (table 4). For coronary artery bypass grafting alone the mortality rate was 5.3% when no arterial conduits were used, 3.5% when LIMA only was used, and 3.7% when BIMA grafting was used (p = NS). The risk of isolated aortic valve replacement for aortic stenosis (4.3%) was not significantly greater than the risk of uncomplicated coronary artery bypass grafting (3.9%). Additional coronary artery bypass grafting increased the risk (7.3%), although this did not reach significance. Although the number of mitral valve replacements in the elderly was small, a trend towards an increased mortality compared with comparable aortic valve procedures is evident (table 3). The most common cause of death was cardiogenic shock (19 deaths), followed by sepsis (three), cardiac arrest (three), bleeding (three), stroke (two), multiorgan failure (two), and acute respiratory distress syndrome (two). There were single instances of death from pulmonary embolism, systemic embolism, and coronary embolism.

The most common non-fatal postoperative complication was transient atrial fibrillation, which affected 37.6% of elderly patients. Reoperation was required in 38 patients (6.6%) for postoperative bleeding (27 patients), additional coronary bypass grafting

Table 4 Thirty day mortality by operation type

	< 70 years old			⩾ 70 years old		
Procedure	Number	Deaths	%	Number	Deaths	%
All surgery	3820	96	2.5	575	39	6.8
Elective surgery	2600	38	1.5	318	17	5.3
Urgent surgery	1106	37	3.3	232	14	6.0
Emergency surgery	114	21	18.4	25	8	32.0
CABG only	3058	39	1.3	334	13	3.9
Elective CABG	2070	20	0.97	169	7	4.1
CABG + valve	219	12	5.5	129	12	9.3
Valve only	371	23	6.2	91	7	7.7
AVR + CABG	135	4	3.0	96	7	7.3
AVR only	179	7	3.9	64	5	7.8
MVR + CABG	54	7	13.0	16	2	12.5
MVR only	87	7	8.1	12	1	8.3
AVR + CABG for AS	92	2	2.2	88	7	8.0
AVR only for AS	86	4	4.6	47	2	4.3

CABG, coronary artery bypass grafting; AVR, aortic valve replacement; MVR, mitral valve replacement; AS, aortic stenosis.

Table 5 Incidence (%) of major postoperative morbidity in patients ⩾ 70 years old

	CVA	IABP	Dialysis	Reoperation	MI
CABG only	1.8	2.7	1.2	6.0	0.9
CABG + valve	1.6	8.5	1.6	9.3	0
Valve only	3.3	1.1	2.2	5.5	0
All surgery	1.9	4.3	1.6	6.6	0.5

CABG, coronary artery bypass grafting; CVA, cerebrovascular accident; IABP, intra-aortic balloon pump; MI, myocardial infarction.

(three), cardiac tamponade (three), gastrointestinal surgery (three), and valve exploration (two). Major morbidity or untoward event including stroke, intra-aortic balloon pump support, acute renal failure requiring dialysis, and perioperative myocardial infarction was uncommon for all operation types (table 5).

Discussion

Cardiac surgery, and coronary artery bypass grafting in particular, has become routine in septuagenarians in the US in the past decade and common in patients over 80 years old. The aging population in the UK is leading to a similar expansion in cardiac surgery in older patients, who previously might not have been considered suitable. It is established in the literature that elderly patients with severe cardiac symptoms may undergo successful cardiac surgery and have a good prognosis, with outcomes similar to age matched controls and a major improvement in quality of life. However, referral patterns may be affected by persisting doubts about the safety of cardiac surgery, particularly in terms of operative mortality and devastating complications such as stroke. Improvements in surgical and bypass techniques and postoperative care have resulted in a progressive reduction in the morbidity and mortality of cardiac surgery in the elderly over the past two decades, although it remains considerably higher than in patients under 70 years old.[3] In-hospital mortality for isolated coronary artery bypass grafting in patients ⩾ 70 years ranges from 2.7%[13] to 12%[14] but has been around 5% in most recent series,[3 6 7] in keeping with a mortality rate of 3.9% in this study for coronary artery bypass grafting alone. In the over 80s, 30 day mortality was twice that of patients in their 70s. In one study of over 200 000 patients ⩾ 70 years old, 30 day mortality for coronary artery bypass grafting alone rose from 5.7% in patients aged 70–74 years to 10.6% in patients over 80 years.[3] Five year survival is around 80% in the best series.[6 15 16]

Use of internal mammary artery grafts in this series is considerably higher than in other studies in the elderly and may help explain low mortality rates. There is increasing evidence that operative mortality is reduced by use of the LIMA graft.[17 18] Doubts have been raised about the safety of BIMA grafting in the elderly,[19] but we found no evidence that additional use of the right internal mammary graft resulted in higher operative mortality.

Valve surgery generally carries a greater risk than coronary artery surgery. However, the risk of isolated aortic valve replacement for aortic stenosis may be similar to isolated coronary artery bypass grafting at 5%.[8 9 20] This risk is increased significantly if the principal lesion is aortic regurgitation[8] or if additional coronary artery bypass grafting is required, with mortality rates rising to 7–12%.[8 9] We found no significant difference in mortality rates between isolated aortic valve replacement for aortic stenosis and coronary artery bypass grafting; both the aortic valve replacement patients who died were over 80 years of age. Mitral valve surgery carries a much higher risk than aortic valve replacement, particularly if there is mitral regurgitation secondary to papillary muscle rupture/dysfunction complicating ischaemic heart disease, with mortality rates around 20% for isolated mitral valve replacement[9] and up to 50% if combined with coronary artery bypass grafting.[21]

Our population received a high proportion of mechanical prosthetic valves. Previous studies have shown that mechanical and biological valves perform similarly but that structural failure is more common with biological valves, particularly in the mitral position.[22 23] However, mechanical valves necessitate long term anticoagulation with its inherent risk of serious bleeding complications. In general terms, the consensus has been that biological valves were indicated for aortic valve replacements for patients ⩾ 65 years and for mitral valve replacement for patients ⩾ 70 years.[24 25] However, given the low operative mortality in this series and excellent long term outcome following valve surgery, these recommendations could be re-examined. We felt that in the majority of cases, life expectancy following successful surgery was such that the risk of reoperation because of failure of a biological valve outweighed the potential risks of bleeding caused by anticoagulation. This influenced the decision to use mechanical valves in all cases of mitral valve replacement and the majority of aortic valve replacements. In the over 80s, where long term durability of the valve was of less concern and bleeding complications of more concern, only six of 22 prostheses were mechanical.

Early mortality in our study was comparable with, or lower than, results from previous studies. The incidence of serious postoperative morbidity was also low for all operation types.

The risk of stroke is a particular concern in the elderly but we have shown a very low incidence of stroke, in keeping with the consistently low level of stroke (2–4%) in previous series of coronary artery bypass grafting in the elderly[7 10 13 14] with similar levels in valvar surgery.[9] The incidence of perioperative myocardial infarction has been more variable in previous series, ranging from 1–11.8%,[7 10 13] but was particularly low in our study at 0.5%. The reasons for this are unclear but may be related to a philosophy of total revascularisation of patients with coronary artery disease.

LIMITATIONS

This study demonstrates acceptably low morbidity and mortality for a range of cardiac operations in patients ⩾ 70 years, although certain caveats should be noted. Studies of this kind are inherently limited as they only include the patients who were accepted for surgery. However, we accepted all patients who were referred, irrespective of age, unless the surgical risk was prohibitively high, although no registry of patients who were not referred by the local cardiologists, or who were referred but were refused surgery, was available. This might lead to a selected sample and possible bias. However, adverse preoperative risk factors, although modest in this series, were similar to previous studies of cardiac surgery in the elderly.

The data included in this study are retrospective but, clearly, with the government's commitment to produce clinical indicators that include the outcomes of surgery, there is an increasing need to collect this type of data prospectively and to consider risk adjustment where appropriate. This study shows that cardiac surgery is successful in older patients, but the implications of widespread cardiac surgery in the elderly need to be addressed. Financial resources in the National Health Service are limited. Studies have repeatedly shown that elderly patients spend longer than younger patients on the intensive care unit and in hospital postoperatively, increasing the costs of surgery.[4 10] However, improved wellbeing and social functioning coupled with a reduced consumption of health care resources, as well as greater independence in daily life, might well defray these higher costs. This warrants further study. We believe that cardiac surgery has an important role in the management of elderly patients with medically refractory cardiac symptoms. Cardiac surgery is more risky in elderly patients compared with patients below 70 years of age, but this should not deter referral of patients with poor quality of life and high dependency on medical care and social services because of cardiac disease.

Appendix

Urgent surgery was defined as surgery during the same admission as an admission for cardiac catheterisation, or during an unplanned admission with cardiac symptoms.

Emergency surgery was defined as surgery that was performed at the earliest opportunity irrespective of the time of day.

Operative mortality was defined as death within 30 days of operation whether at the base hospital, at home, or at another hospital.

Unstable angina was defined as angina severe enough to require admission to hospital and treatment with intravenous heparin or nitrates, with cardiac catheterisation taking place at the earliest opportunity.

Poor left ventricular function was defined as left ventricular ejection fraction < 30%.

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